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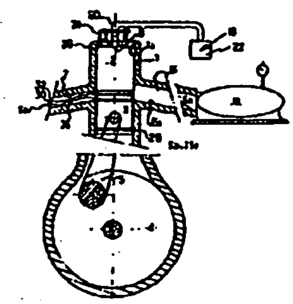
54 **Procedure for improving the function of a short-cycle internal combustion engine, and short-cycle internal combustion engine with improved function and simplified structure.**

57 The invention concerns a procedure and a short-cycle internal combustion engine with improved function.

This engine is characterized in that each cylinder 1 is free of any valve, lift-type valve, or regulator or the like, such that the intake orifice 6 and the exhaust orifice 7 are continuously freely open. Means 10 for injection of air continuously supply the air under pressure in the direction of the intake orifice 6. In addition, the crankshaft 4 rotation angle at which this intake orifice 10 is released by the piston 3 is greater than the crankshaft rotation angle at which the exhaust orifice 7 is released by the piston 3.

A short-cycle operation is thus obtained, i.e. less than two strokes leading to maximums of torque and power that coincide.



FR 2 583 108 – A2

The present invention essentially concerns a procedure for improving the function of a short-cycle internal combustion engine, and a short-cycle internal combustion engine with improved function and simplified structure.

Every internal combustion engine currently known comprises at least one cylinder, defining a combustion chamber, provided with at least one orifice for air intake and at least one orifice for exhaust of combustion gas, the said orifices being arranged in the lateral wall of the cylinder and a piston that moves alternately between a top dead center (TDC) point and a bottom dead center (BDC) point. The piston is connected to a crankshaft by a classic connecting rod system in such a way as to transform a continuous alternating movement into a rotary movement. Means for injecting fuel are also provided, this injection usually being carried out in the intake air. This fuel can be of the light type, the gasoline type, of the heavy gas-oil type, oil, etc.

In all four-stroke engines, the orifices for air intake and exhaust of the burned gases are arranged at the top of the cylinder. These intake and exhaust orifices are normally closed by intake and exhaust valves, respectively, that require a control system of valve rockers and cam shaft. This creates a significant complication of the engine construction and the need to bring numerous parts into motion. Besides that, in four-stroke engines, the filling of the combustion or explosion chambers is never perfect, which increases fuel consumption.

On the other hand, in the known two-stroke engines, the function cycle comprises, during the time the piston ascends the first time, a pre-mixture of

air and fuel taken in at the bottom of the cylinder. During the descent of the piston, a transfer from the pre-mixing chamber into the combustion chamber occurs through the orifices provided in the piston and simultaneously an evacuation of the burned gases from the combustion chamber occurs. The second time the piston ascends, it produces the compression and explosion of the transferred gases and the cycle starts over. Thus it is possible to confirm that the transfer of the pre-mixtures of air and fuel from the pre-mixing chamber to the combustion chamber occurs at the time when the burned gases are evacuated from the combustion chamber. This necessarily leads to a significant intolerable loss of fuel that passes directly to the exhaust at the time of the transfer.

Interest in two-stroke engines is based on their power, their simplicity in function, their service life, and the very reduced number of moving parts.

The document relating to the two-stroke engine that is considered most significant by the requesters is US-A-2 522 649. However, according to the engine that is the object of Figures 1 to 12, a piston 43 is provided for compression of the air-fuel mixture before it is introduced into the combustion cylinder. This piston thus supplies an alternative pressure. This compression piston 43 is provided in such a way that a closure of the intake orifice occurs until the piston 33 arranged in the combustion chamber 10 releases the exhaust orifice 25 (see Figures 2 and 3). In other words, this compression piston 43 makes up a sort of valve or a lift-type valve since it is also actuated by the crankshaft 23.

The injection of the fuel is always carried out in the air in front of the compression piston in such a way that the piston compresses an air-fuel mixture.

The engines described in this document still present the disadvantage of being relatively complicated due to the presence of a special air compression piston, thus they are costly. Besides that, the torque/power ratio of these engines is average or mediocre, taking into account the functioning conditions described in this document.

Thus, the object of the present invention is to eliminate the disadvantages of the prior art by providing a solution that combines the advantage of the four-stroke engine with those of the two-stroke engine without their respective disadvantages.

Thus, according to the present invention, a procedure is provided for improving the function of a short-cycle internal combustion engine comprising at least one cylinder that defines a combustion chamber, provided with at least one orifice for air intake and at least one orifice for exhaust of the combustion gases, the said orifices being arranged in the lateral wall of the cylinder, a piston with movement alternating between a top dead center point and a bottom dead center point arranged in the said cylinder and closing or releasing each of the said orifices during its movement, the said piston being connected to a crankshaft by a classic connecting rod system, comprising a compression and an explosion each time the piston ascends toward the top dead center point, an injection of compressed air into the cylinder, called supercharging, and an injection of fuel, characterized in that in order to radically simplify the design of the engine, in particular by limiting to a minimum the moving parts, each cylinder is free of any valve, lift-type valve, regulator, or the like in such a way that the intake orifice and the exhaust orifice will be freely open, air under pressure is injected continuously in the direction of the intake orifice, the fuel is injected directly into the cylinder

independently of the air, the position of the intake orifice is provided relative to the exhaust orifice in such a way that the intake orifice will be released by the piston during an angle of rotation of the crankshaft that is greater than the angle of rotation of the crankshaft at which the exhaust orifice is also released by the piston, in such a way as to also start the intake of air before the exhaust and to end the intake of air after the exhaust; preferably the angle of rotation of the crankshaft at which the intake orifice is released by the piston being greater than 180°.

According to one embodiment that is actually preferred, the crankshaft rotation angle at which the intake orifice is released by the piston is between about 200 and 220° while being symmetrical with respect to the bottom dead center point.

According to yet another characteristic of the procedure according to the invention, the crankshaft rotation angle at which the exhaust gas orifice is released by the piston is less by about 10 to 60°, and preferably about 20 to 40°, of the crankshaft rotation angle at which the air intake orifice is released by the piston.

According to yet another characteristic of the procedure according to the invention, the crankshaft rotation angle at which the exhaust orifice is released by the piston is between 170 and less than 180° while remaining symmetrical with respect to the bottom dead center point.

According to another characteristic of the procedure according to the invention, the total cross section of the air intake orifice or orifices is provided in such a way that it will be essentially equal to two times that of the exhaust orifice or orifices.

According to another characteristic of the procedure according to the invention, at the bottom dead center point, the piston is located in the area of the lower edge of the exhaust orifice and preferably also simultaneously of the lower edge of the intake orifice.

According to another characteristic of the procedure according to the invention, the compression of the air is carried out using a compressor or booster, preferably driven by the crankshaft in such a way that the air pressure will be a function of the engine rotation speed.

According to another characteristic of the procedure according to the invention, the ratio of the height of each intake orifice with respect to the piston travel is between about 0.45 and about 0.65, while the ratio of the height of each exhaust orifice with respect to the piston travel is between about 0.40 and about 0.55, the relative ratio with the exhaust orifice being lower than the relative ratio with the intake orifice.

According to the present invention, a short-cycle internal combustion engine is also provided with improved function and simplified structure, comprising at least one cylinder defining a combustion chamber, provided with at least one orifice for air intake and at least one orifice for exhaust of combustion gas, the said orifices being arranged in the lateral wall of the cylinder, a piston that moves alternately between a top center point and a bottom dead center point arranged in the said cylinder, the piston being connected to a crankshaft by a classic connecting rod system, the intake orifice being offset toward the top of the cylinder in comparison to the exhaust orifice, the means for injecting air being provided that carry out an injection of air under pressure into the cylinder, called supercharged injection, and

means for injecting fuel are also provided, characterized in that each cylinder is free of any valve, any lift-type valve, or regulator or the like, in such a way that the intake orifice and the exhaust orifice would be continuously freely open, the means for injecting fuel opening directly into the cylinder and independent of the means for injection of air that inject air continuously in the direction of the intake orifice, the crankshaft rotation angle at which the intake orifice is released by the piston is greater than the crankshaft angle of rotation at which the exhaust orifice is released by the piston. Preferably, this engine also has all the characteristics corresponding to those that have been mentioned above relating to the procedure of the invention.

Thus, it will be observed that the invention makes it possible to provide an engine without any valve, lift-type valve, regulator, or the like and without crankcase pressure.

There are no parts in motion other than the piston and the crankshaft. The air is admitted freely and ensured continuously under pressure.

Simply the alternating movements of the piston in the cylinder make the intake of air into the cylinder and/or the exhaust of the contents of the cylinder (air and/or combustion gas) possible.

On the other hand, air intake takes place at more than 180° and starts before and ends after the exhaust, since only one explosion takes place each time the piston ascends toward the top dead center, a short-cycle engine is obtained, i.e. comprising one cycle which is less than that of a two-stroke engine, as it will be possible to understand using the diagram showing the functioning principle of the engine.

Due to these characteristics, in a manner that would not be expected by a person skilled in the art, an essentially flat torque maximum is obtained as in a four-stroke engine. Besides that, the increase in power is fast, as for two-stroke engines.

Besides that, there is an intersection of the curves for torque and power as in four-stroke engines.

Finally, and in a completely unexpected manner, the maximums of torque and power practically coincide while being relatively flat and being essentially constant over practically 1,500 rpm.

Besides that, due to the direct injection of the fuel into the cylinder, minimum fuel consumption is achieved.

Also, an important characteristic of the invention is that the upper part of the engine is of a single piece, plus the crankcase, thus eliminating the problems of the head gasket and the different contingencies that are usually encountered.

Due to the pressure of the intake air, the additional advantage is gained of maximum evacuation of burned gas due to the turbulence caused by the continuously injected fresh air, which leads to a decrease in engine heating.

The pressure of the supercharged air is optional and will be a function of the desired performance of the engine, as is well known to the person skilled in the art.

Other goals, characteristics, and advantages of the invention will be seen clearly in view of the explanatory description that will be given below with reference to the attached drawings, in which:

- Figure 1 shows a schematic view of a partial vertical cross section of the engine according to the invention at the level of one cylinder;

- Figure 2 shows a diagram of the function principle of this engine; and
- Figure 3 shows the curves of torque and power as a function of the engine rotation speed.

With reference to Figures 1 to 3, the internal combustion engine comprises at least one cylinder 1, defining a combustion chamber 2, provided with at least one air intake orifice 6, and at least one exhaust orifice 7 for combustion gases, the said orifices being arranged in the lateral wall of cylinder 1, a piston that moves alternately between a top dead center point and a bottom dead center point arranged in the said cylinder. The piston 3 is connected to a crankshaft 4 by a classic connecting rod system 5.

The air intake orifice 6 is offset toward the top of the cylinder 1 with respect to the exhaust orifice 7. However, the intake orifice 6 and exhaust orifice 7 are located at a certain distance from the top or tip 1a of the cylinder. Preferably, several intake orifices 6 are located in the upper two-thirds of the cylinder.

This engine also comprises air injection means 10 that carry out an injection of air under pressure into cylinder 1, called supercharged injection. These air injection means 10 can be made up by a classic compressor or a classic booster or preferably, according to the invention, the air compression means are actuated by the crankshaft and thus supply an air pressure that is a function of the engine rotation speed.

These means for injection of air under pressure thus make up an air pump driven by the engine and are able to supply the necessary air into the cylinder 1 by scavenging or filling.

Means for injecting fuel 18 into the cylinder 1 are also provided, independently of the means for injection of air 10 and according to the invention, providing a direct injection through orifice 8.

This engine is also characterized in that each cylinder 1 has no valve, no lift-type valve, or regulator or the like, in such a way that the intake orifice 6 and the exhaust orifice 7 are continuously freely open, which is well understood from a consideration of Figure 1.

In addition, the air injection means 10 continuously supply the air under pressure in the direction of the intake orifice 6.

In addition, the crankshaft rotation angle at which the intake orifice is released by the piston is greater than the crankcase rotation angle at which the exhaust orifice is released by the piston.

Thus, due to the continuous feed of air under pressure in the direction of the intake orifice, the engine according to the invention starts the air intake before the exhaust and ends the air intake after the exhaust.

In addition, the crankshaft rotation angle at which the intake orifice is released by the piston is planned to be greater by about 10 to about 60° than the crankshaft rotation angle at which the exhaust orifice is released by the piston.

According to another characteristic of the engine according to the invention, the crankshaft rotation angle when the intake orifice is released by the piston is greater than 180°.

According to a still more preferred characteristic, the crankshaft rotation angle at which the intake orifice is released by the piston is

between 200 and 220° and it is arranged in a symmetrical manner with respect to the lower dead center point while the crankshaft rotation angle at which the exhaust orifice is released by the piston is between about 170° and less than 180°.

According to yet another characteristic of the engine according to the invention, the lower edge 7a of the exhaust orifice 7 is provided in such a way as to be located in the area of the bottom dead center point of piston 3.

In addition, preferably the intake orifice 6 has it lower edge 6a that is also located in the area of the bottom dead center point of piston 3.

According to another characteristic of the engine according to the invention, the total cross section of the air intake orifice(s) 6 is essentially equal to two times that of the exhaust orifice(s) 7.

Besides that, according to yet another preferred characteristic of the engine according to the invention, the ratio of the height of each intake orifice 6 with respect to the piston travel is between about 0.45 to 0.65, while the ratio of the height of each exhaust orifice 7 with respect to the piston travel is between about 0.40 and about 0.65, the relative ratio with respect to the exhaust orifice 7 being less than the relative ratio to the intake orifice 6.

It is easy to understand that several orifices for intake 6 or exhaust 7 may be provided. These orifices for intake 6 and exhaust 7 are preferably located in the upper two-thirds of the cylinder.

Means for injection of fuel 18 comprise a fuel injection orifice 8, a fuel injector 20, and an injection pump 22.

This injection pump may be traditional whether the fuel is light like gasoline or heavy like gas-oil (diesel engine).

In addition, in the case of light fuel like gasoline, a traditional ignition 24 is provided, for example with spark plug 26.

The function of this engine thus described is according to the procedure already mentioned and is the following, with reference to Figures 2 and 3, and mainly with reference to Figure 2.

Thus, at the bottom dead center point, the intake orifice 6 and the exhaust orifice 7 are completely released, in such a way that the air is supplied under pressure by the intake orifice 6 from means for supercharging 10.

In the preferred case of supercharging means 10 actuated by the crankshaft 4, the supply pressure is a function of the engine rotation speed. For example, the pressure is 1.008 bar at start-up and reaches 1.5 bar at 3,500 rpm. Naturally, these values are simply given by way of example, given that the supercharging pressure value may be any whatsoever, as is well known by the person skilled in the art.

Thus, given that the exhaust orifice 7 is free and opens freely to the atmosphere, the pressure in the combustion chamber 2 is greater than the pressure in the exhaust line in such a way that the intake air under pressure scavenges the combustion chamber 2 and promotes the exhaust of the combustion gases or burned gases.

Gradually as the piston 3 rises, the exhaust orifice 7 is closed while the intake orifice 6 is again partially opened due to the offset provided between the intake orifice 6 and the exhaust orifice 7, as in the position

shown in Figure 1. Thus, at this moment, a complete filling of the cylinder with air takes place with a pre-compression due to the injection of the air under pressure, in such a way that the volume of air to be compressed will become greater.

Piston 3 continues to rise toward the top of cylinder 1, completely closing the intake orifice 6 and thus producing the compression of the air to the top dead center point.

Just before arriving at the top dead center point, the fuel is injected by the injection means 18 comprising the injection pump 22. In the case of an engine with light fuel, of the gasoline type, the complete injection of the fuel is carried out before the spark plug sparks, this ignition being traditional for spark plug ignitions.

In the case of an engine with heavy fuel like gas-oil, oil, etc., the injection is carried out several degrees before the top dead center point, by a high pressure pump and there is no ignition system as is well known by the person skilled in the art.

Thus the explosion is obtained just before the top dead center point and the descent of piston 3 then starts by implementing the delay in chamber 2 until the piston 3 begins to release the intake orifice 6 (PIO = point of intake opening).

According to the pressure level of the supercharging, the pressure value at the intake orifice 6 is lower than, equal to, or higher than the pressure of the delay occurring in chamber 2.

The supply pressure value is not important since even if it is lower than the pressure value present in chamber 2, the combustion gases do not escape through the intake orifice 6 except for during a fraction of a second due to the delay at the opening of the exhaust orifice on the order of 10

to about 60° of the crankshaft rotation angle 4 over the entirety of the duration of the intake and of the exhaust, which yields a range at the moment of opening or of closing of the exhaust, in comparison to the opening or the closing of the intake, of only 5 to 30° crankshaft rotation angle. The result of this is that the combustion gases escape almost instantly through the exhaust orifice 7 when the piston comes to its release rotation, at the instant PEO = point of exhaust opening.

This offset between intake and exhaust for the opening is essential since the continuous supply of air under pressure in the intake duct 6 makes it possible to cool the intake duct and also the piston 3 before the intake orifice is released, but also when it becomes released while the exhaust orifice is blocked, this cooling being greatly amplified at the time of very significant scavenging that takes place at the moment the exhaust orifice 7 is released by the piston 3.

At this moment (PEO), an intensive scavenging starts due to the fresh air coming from the intake orifice 6 to the point PEC = point of exhaust closing.

According to the invention, the duration of exhaust, expressed in crankshaft rotation angle, is less than 180°, and preferably is between about 160 and less than 180°. In the example shown in Figure 2, the crankshaft rotation angle (PEC-PEC) at which the exhaust orifice 7 is released by the piston, is equal to 175°.

Thus, as mentioned above, due to this very significant scavenging by the air, the head of the piston, the cylinder, and the exhaust would be an extremely low functioning temperature, the cooling of the interior of the engine is very significant, which improves

the ease of functioning. In fact, there is very little expansion and a very low machining tolerance is sufficient.

In the same way, with the same offset in crankshaft rotation angle as for the opening, the intake being ended at the point PIC = point of intake closing, the duration of the air intake, expressed in crankshaft 4 rotation angle is thus greater than 180° and preferably is between 200 and 220°.

In the example shown, this total intake duration is 200°. It will be noted that these durations of intake and exhaust are arranged symmetrically with respect to the bottom dead center point.

Under these conditions, in the example shown, the duration of compression expressed as crankshaft rotation angle is 92.5° and it is the same as the delay, taking the point PEO – point of exhaust opening as the final delay point.

It will be noted that the supercharging of the engine is promoted due to the fact that the entire cross section of the intake orifices 6 is essentially equal to two times the total cross section of the exhaust orifices 7.

In addition, the positioning of the intake and exhaust orifices is also critical. According to the invention, as mentioned above, the ratio of the height of each intake orifice 6 with respect to the piston travel is between about 0.45 to about 0.65 while the ratio of the height of each exhaust orifice 7 with respect to the travel of piston 3 is between about 0.40 and about 0.55, the relative ratio of the exhaust orifice 7 being less than that of the intake orifice 6.

It will be noted that, during the entire cycle duration, the air pressure in the intake is constant and promotes proper cooling of the piston and of the cylinder.

A short-cycle function is thus obtained, i.e. less than one cycle of a two-stroke engine since when the exhaust is ended, the intake and filling of the following cycle are also practically completed.

The theoretical pressure diagram is shown in Figure 3 and becomes an integral part of the descriptive text of the patent.

In addition, as can be seen from Figure 4, the engine according to the invention has power and torque curves that are entirely novel and unexpected for the person skilled in the art.

Thus these curves have an intersection point I located before 2,000 rpm. In addition, and in an entirely novel manner, the maximum of the torque curve is essentially flat in such a way that the maximum torque is constant over practically 1,500 rpm, i.e. from 3,500 to 4,500 rpm, which is absolutely remarkable.

In addition, this torque maximum essentially coincides with the power maximum, the power maximum also being essentially flat. Thus, this engine system yields expanded acceleration with exceptional power and torque.

One engine currently subjected to testing, of the diesel type with a useful cylinder volume of 300 cm^3, yields a power of 30 HP at 3,500 rpm in comparison to a commercial engine with the same cylinder that supplies only a power of 6 to 9 HP according to the brand, with the same fuel consumption.

Besides that, it can be observed that good commercial diesel engines yield 30 to 35 HP per liter, the diesel turbo engines yield 30 to 45 per liter.

The engine according to the present invention yields a minimum of 100 HP per liter with equal consumption with an engine with the same cylinders, but which performance is at least three times smaller.

This performance can be attributed to direct injection of the fuel in the combustion chamber 2, to the supply of air under constant pressure over the course of the same cycle, with the critical intake and exhaust durations mentioned above.

In the example shown, the height of each intake orifice is 39 mm, that of each exhaust orifice is 34 mm, the lower edge of each intake orifice 6 and exhaust orifice 7 coinciding with the bottom dead center point, the total intake surface being 15.38 mm^2 and that corresponding to the exhaust being 7.69 mm^2. The piston travel is 72 mm.

It will also be understood that the lubrication of the parts in motion in the lower crankcase is carried out either by bubbling or by pressure due to an oil pump. In the engine, the lubrication is limited to the lubrication of the bearings, of the crankshaft, and of the connection rod (top and bottom) of the roller bearings. Sealing of the base of the piston and of the base or the crankcase is implemented by a scraper 28 segment preventing the lifting of the oil and which is located above the exhaust orifice 7 and thus the intake orifice 6 at the top dead center point. For this reason, the height of the piston is greater than the travel of the scraper segment.

Other sealing segments 30, 32 are also provided, in the classic manner for sealing the gas in the combustion chamber 2.

The piston may have a traditional form for the use of a heavy fuel while in the case of a light fuel, the piston may be flat or curved according to the desire compression.

Naturally, the invention comprises all the means making up the technical equivalents of the means described as well as their various combinations.

CLAIMS

1. – Procedure for improving the function of a short-cycle internal combustion engine comprising at least one cylinder that defines a combustion chamber, provided with at least one orifice for air intake and at least one orifice for exhaust of the combustion gases, the said orifices being arranged in the lateral wall of the cylinder, a piston with movement alternating between a top dead center point and a bottom dead center point arranged in the said cylinder and closing or releasing each of the said orifices during its movement, the said piston being connected to a crankshaft by a classic connecting rod system, comprising a compression and an explosion each time the piston ascends toward the top dead center point, an injection of compressed air into the cylinder, called supercharging, and an injection of fuel according to any one of the claims of the base patent 84 09 685), characterized in that in order to radically simplify the design of the engine, in particular by limiting to a minimum the moving parts, each cylinder is provided without any valve, lift-type valve, regulator, or the like in such a way that the intake orifice and the exhaust orifice will be freely open, air under pressure is injected continuously in the direction of the intake orifice, the fuel is injected directly into the cylinder independently of the air, the position of the intake orifice is provided relative to the exhaust orifice in such a way that the intake orifice will be released by the piston at an angle of rotation of the crankshaft that is greater than the angle of rotation of the crankshaft at which the exhaust orifice is also released by the piston, in such a way as to also start the intake of air before the exhaust and to end the intake of air after

the exhaust, preferably the angle of rotation of the crankshaft at which the intake orifice is released by the piston being greater than 180°.

2. – Procedure according to Claim 1, characterized in that the crankshaft rotation angle at which the intake orifice is released by the piston is between about 200 and 220°, while being symmetrical with respect to the bottom dead center point.

3. – Procedure according to Claim 2, characterized in that the crankshaft rotation angle at which the exhaust orifice is released by the piston is less than around 10 to 60° and preferably about 20 to 40° then the crankshaft rotation angle at which the intake orifice is released by the piston.

4. – Procedure according to Claim 3, characterized in that the crankshaft rotation angle at which the exhaust orifice is released by the piston is between 170 and less than 180° while being symmetrical with respect to the bottom dead center point.

5. – Procedure according to one of the preceding claims, characterized in that the air is compressed with the use of a compressor or a booster, preferably actuated by the crankshaft in such a way that the air pressure will be a function of the engine rotation speed.

6. – Procedure according to one of Claims 1 to 5, characterized in that at the bottom dead center point, the piston is located in the area of the lower edge of the exhaust orifice and preferably also simultaneously of the lower edge of the intake orifice.

7. – Procedure according to one any of the Claims 1 to 6, characterized in that the total cross section of the air intake orifice or orifices is essentially equal to two times that of the exhaust orifice or orifices.

8. – Procedure according to one any of the preceding claims, characterized in that the ratio of the height of each intake orifice with respect to the piston travel is between about 0.45 and about 0.65, while the ratio of the height of each exhaust orifice with respect to the piston travel is between about 0.40 and about 0.55, the ratio with respect to the exhaust orifice being less than the ratio with respect to the intake orifice.

9. – Short-cycle internal combustion engine with improved function and simplified structure, comprising at least one cylinder (1) defining a combustion chamber (2), provided with at least one orifice for air intake (6) and at least one orifice for exhaust (7) of combustion gases, the said orifices being arranged in the lateral wall of the cylinder, a piston (3) that moves alternately between a top dead center point and a bottom dead center point arranged in the said cylinder, the piston being connected to a crankshaft (4) by a classic connecting rod (5) system, the air intake orifice (6) being offset toward the top of the cylinder in comparison to the exhaust orifice, means for injecting air (10) being provided that carry out an injection of air under pressure into the cylinder, called supercharged injection, and means for injecting fuel (18) are also provided, characterized in that each cylinder (1) is free of any valve, any lift-type valve, or regulator or the like, in such a way that the intake orifice (6) and the exhaust orifice (7) would be continuously freely open, the means for injecting air (10) continuously supplying

air under pressure in the direction of the intake orifice (6), the crankshaft (4) rotation angle at which the intake orifice (6) is released by the piston (3) is greater than the crankshaft angle of rotation at which the exhaust orifice (7) is released by the piston (3).

10. – Engine according to Claim 9, characterized in that the crankshaft rotation angle at which the intake orifice is released by the piston is greater by about 10 to about 60° than the crankshaft rotation angle at which the exhaust orifice is released by the piston, the crankshaft rotation angle at which the intake orifice is released by the piston being greater than 180°.

11. – Engine according to Claim 10, characterized in that the crankshaft rotation angle at which the intake orifice is released by the piston is between 200 and 220° and is arranged in a way that is symmetrical with respect to the bottom dead center point while the crankshaft rotation angle at which the exhaust orifice is released by the piston is between about 170° and less than 180°.

12. Engine according to one of Claims 9 to 11, characterized in that the lower edge (7a) of the exhaust orifice (7), preferably as well as the lower edge (6a) of the intake orifice (6) are provided in such a way as to be located in the area of the bottom dead center point of the piston.

[see source for figures 1 and 2]

[key:]

INJECTION = INJECTION

EXPLOSION = EXPLOSION

DÉTENTE = DELAY

ÉCHAPPEMENT = EXHAUST

ADMISSION = INTAKE

COMPRESSION = COMPRESSION

[see source for figure 3]

[key:]

Puissance = Power

Couple = Torque

Process for improving the functioning of a short-cycle internal combustion engine, and internal combustion engine with improved short cycle functioning and simplified structure

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Applicant: HAZERA PATRICK (FR)
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- international: F02B25/14; F02B41/04; F02B75/02; F02B25/00; F02B41/00; F02B75/02; (IPC1-7): F02B25/02; F02B75/02
- european: F02B25/14; F02B41/04; F02B75/02
Application number: FR19850008759 19850610
Priority number(s): FR19850008759 19850610; FR19840009685 19840620

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Abstract of **FR2583108**

This engine is characterised in that each cylinder 1 is devoid of valves, throttles or regulators or similar devices so that the inlet port 6 and the exhaust port 7 are permanently freely open. Air injection means 10 constantly feed air under pressure towards the inlet port 6. In addition, the angle of rotation of the crankshaft 4 during which the inlet port 10 is cleared by the piston 3 is greater than the angle of rotation of the crankshaft during which the exhaust port 7 is cleared by the piston 3. Short cycle functioning is thereby obtained, that is to say less than two strokes resulting in maximum torque and power output which coincide.